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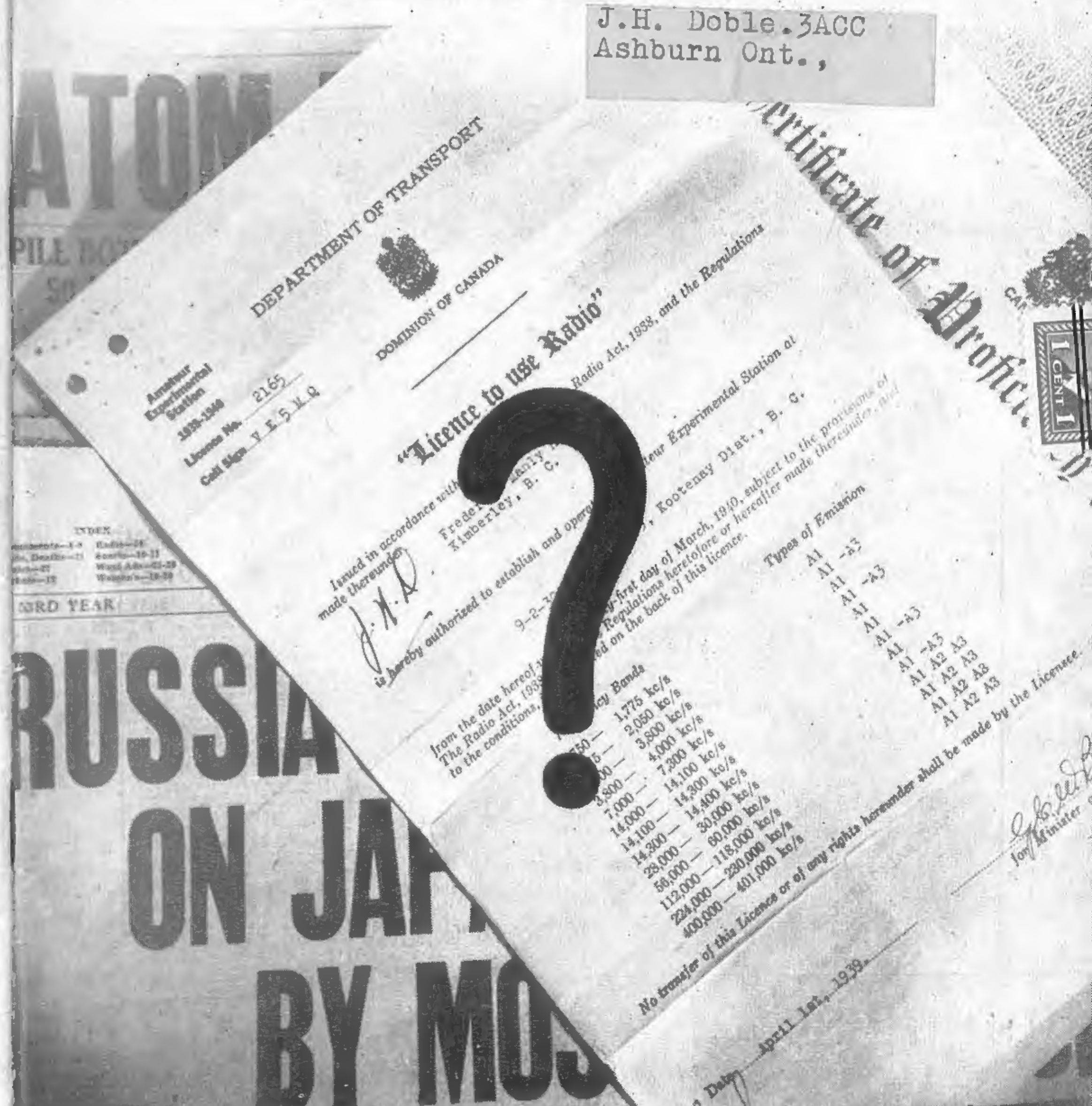
XTAL

J.H. Doble.3ACC
Ashburn Ont.,



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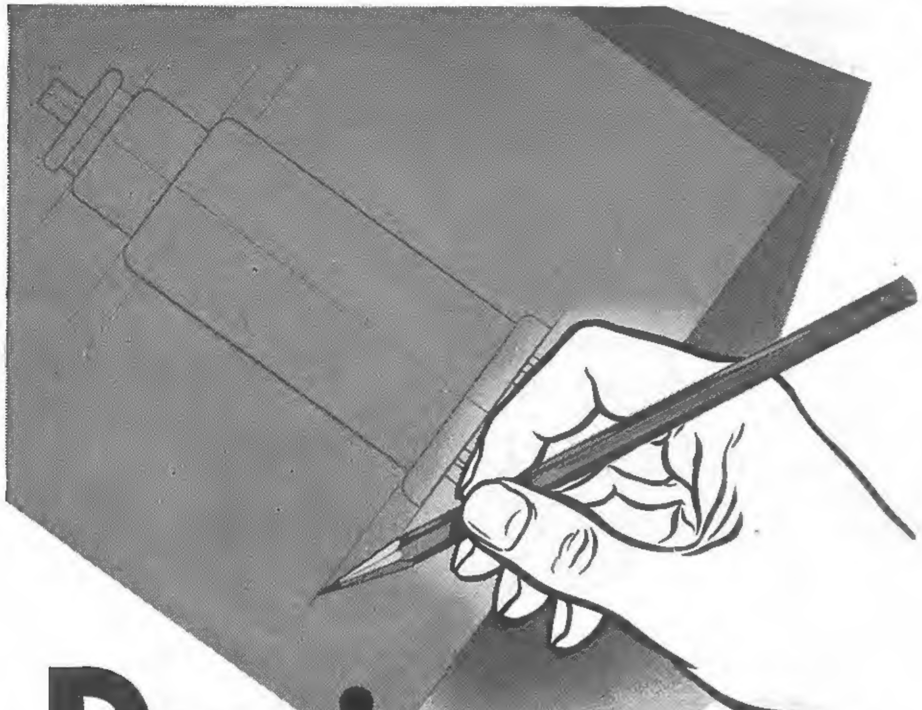

R. S. G. B.

XTAL

A. R. R. L.

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CANADIAN AMATEUR RADIO OPERATORS' ASSOCIATION

LEASIDE P.O., ONTARIO

ARE WE READY?

WE talked to the RI to-day, August 27th. He's being besieged with calls. "When do we get back on the air?" He doesn't know for sure, but he guesses it won't be long. However, he and we agree that releasing the air lanes for Amateur Radio does not hold too high a priority, when we take into consideration all the more necessary things the Government has to do toward getting Canada back to peace-time living. However, that we'll be on is as certain a bet as anything could be.

But the RI is also worried. In the old days the amateurs were pretty well trained to look after interference created by themselves. We wonder if you fellows are really ready? Have you had a chance to pull the junk out of the basement? Do you know that the old transformers are not seeped with moisture? Have you had a look at some of the parts under the chassis? Have you noticed mould, and how poor some of those soldered joints are? Have you also considered you new antennae? Have you done anything about it? Yes, and a good one is going to be essential shortly. How's the frequency meter? We'll lay some on the line that it won't even oscillate, let alone be anywhere near calibration. Yes, and the bet still holds even if it has a crystal in it. So, you see, the RI has cause for worry if we all throw this stuff together and suddenly get on the air. He's short-handed, the same as everybody else, and he's hoping we'll not forget the Amateur Creed, that we'll conduct ourselves as we used to do.

At the moment it looks as if old 160 is gone, and that we'll have 21 to 21.5 mc. in its stead. 80, 40 and 20 will probably remain about the same. Ten will be 28 to 29.7 mc. Five has become 50 to 54 mc. In addition there are a flock of V.H.F. bands for our use. The International Conference at Rio will be under way when this is read. Soon after that we anticipate exact details and release to us of the new ham bands.

So, take a look fellows, get after the many things that should be done in the meantime, so that we'll all be set when the time arrives and VEs will become the envy of the Amateur air.

We find, from the Department of Transport's list of VE addresses to September, 1939, that hundreds of you are at new addresses. We are informing the Department of the new addresses of all of you who are members of our Association. To those of you who are not please inform the Department of your present address in order to expedite their informing you regarding renewal of your licence, etc. Or, if you wish, drop us a line and we'll be glad to pass it on.

S.B.T.

as such requires only a single-pole switch for band-switching, and the coils are only single untapped windings. The principle of operation is quite simple, and is as follows:

Any small change of voltage occurring in the tuned circuit in the plate of the left-hand triode is coupled into the right-hand grid and thence to the common cathode (the right-hand triode acting as a cathode follower)). This change of cathode voltage acts like a change in the opposite sense on the left-hand grid, thus influencing the flow of plate current in such a way as to reinforce the original voltage change in the tuned circuit. This cycle describes the process of regeneration, which is sufficient, with the circuit used, to cause oscillation. The cathode provides a convenient output point of fairly low impedance. The circuit has not been explored very fully by the writer, but it oscillates very well up to and above 36 mc., appears to be very stable, and is not too fussy about component values. The total cathode current is about 10 ma. A 6SN7 would probably work equally well with the same circuit values.

The R.F. Amplifier performs the function of a buffer between the oscillator and the test circuit, and provides a very high output impedance due to the a.c. plate resistance characteristics of the 6AC7. Since this plate resistance and the resistor R14 shunt the tuned circuit under test, it is desirable to keep its value as high as possible to avoid dampening the tuned circuit appreciably, thus broadening the resonance curve and giving a false reading of Q. The 6AC7 was chosen because it combines high plate resistance (1 meg.) with high transconductance, thus giving ample output. The screen potentiometer P1 serves as an output control for adjusting the amplitude of the r.f. voltage across the tuned circuit to a suitable level for measurements. Grid leak bias is employed on this stage, giving a degree of a.g.c. action so that its output is thus made more constant over the frequency range. The full output from the oscillator is deliberately applied to the amplifier grid, thus over-driving the latter to produce an output current rich in harmonics, which are useful for certain Q measurements to be described later in this article. It should be noted that the presence of harmonics does not detract from the usefulness of the instrument, since the fundamental may always be identified as the highest frequency setting that gives a resonance indication. On the other hand, the harmonics may be very useful when the unit is used as an ordinary signal generator (e.g., to provide calibration points across a receiver dial the single frequency setting of 100 Kc. will give a long train of signals spaced 100 Kc. apart. These may be in turn synchronized with a standard frequency broadcast from WWV by zero-beating).

The V.T.V.M. operates on the slideback principle, so that very light loading is imposed by it on the test circuit. It consists of the diode V4 and the magic eye indicator V5. The left-hand half of V4 rectifies the difference between the peak r.f. voltage across the tuned circuit and the slideback voltage appearing on the diode cathode. The rectified negative voltage is fed via R14, R13, etc., to V5 grid, where it starts to close the eye. When the slideback voltage is adjusted by P2, until the eye just begins to close, then the slideback voltage just equals the peak r.f. voltage. In use this is done with the test circuit at resonance, and with the "Q-switch" in the "HI" or shorted position. The actual value of slideback voltage is not measured. The "Q-switch" is then switched to the "LO" or open-circuit position, which automatically reduces the slideback voltage to 70.7% of its former value, and the "Q" dial (C3) is tuned off resonance on both sides to the points where the eye is just on the verge of starting to close again; and the Q reading is thus obtained. The right-hand diode of V4 is used, for lack of a better purpose, to generate contact potential in opposition to that of the left-hand diode, thus eliminating a small error that might otherwise occur when indicating low voltages.

Constructional Details:

The instrument is built in a compact, sturdy metal cabinet, and the oscillator components in particular are ruggedly mounted to avoid frequency instability due to vibration or chassis distortion. Short leads are used in all of the signal circuits from the oscillator through to the output terminals. Grounds are short and direct, and mechanical joints are not relied upon for connection to the chassis. The r.f. by-pass condenser C5 was added, even though it is in parallel with C2, since the latter is merely a filter condenser which becomes ineffective at the higher frequencies. The r.f. by-pass condensers C6, C9, C11, and the r.f. coupling condensers C7, C8, C10 all have leads as short as possible, and all are micas. R14 has been chosen for operation at high frequencies, since it shunts the tuned circuit under test. (Insulated types such as I.R.C. type BT are generally unsatisfactory, since their resistance drops tremendously at high frequencies. Non-insulated types such as I.R.C. type M are suitable.)

COIL DATA

Frequency Bands (all tuned with 500 mmf.)

Band	Range, Kc.	Microhenries	Winding Data
I.	50-150	20000	20 millihenry pi-wound r.f.c.
II.	150-450	2220	2.5 millihenry pi-wound r.f.c. (turns removed if required).
III.	450-1350	250	200 turns No. 40 enam. close-wound on ½" dia.
IV.	1350-4050	27.5	55 turns No. 32 enam. close-wound on ½" dia.
V.	4000-12000	3.00	15 turns, 2 strands No. 32 enam. in parallel, close-wound on ½" dia.
VI.	12000-36000	.340	5½ turns No. 14 air-wound ⅝" dia. spaced to ½" winding length.

All above based on min. circuit capacity 50 mmfd. or effective tuning cap. range 50-550 mmfd.

No attempt has been made, of course, to have short leads for power supply wiring, potentiometer leads, Q-switch circuit and voltage divider, and the magic eye circuit, although R4 is mounted right at the socket of V3, and R14 and R15 at the socket of V4. The tube sockets for V3 and V4 are of low-loss material for efficient high frequency operation, as well as the insulating mounting the test terminals.

The photographs in Part II show some of the details (including faults) of the writer's instrument. The two-gang tuning condenser, the use of which was originally planned with both halves in parallel, was solidly mounted in place before the success of the present oscillator was proven. Now only one 500 mmf. section is used, since it was such a simple matter to include six bands, and thus achieve greater accuracy. The chassis and cabinet of the writer's instrument were available, with most of the holes already punched, and this accounts for the queer layout, with the test terminals at the rear. If starting from "scratch," is may be more desirable from an operating standpoint to have these on top, or on the front panel; but above all, the leads should be kept short.

The construction of the movable Q indicator is simple. The pointer is a piece of phosphor bronze with a clearance hole in it to slide over the threads of the panel bushing mounting C3. After the pointer is put on, a star spring washer and a pair of lock-nuts complete the assembly. The pointer is thus free to move without rotating the condenser shaft; and the spring washer holds it in any desired position. A small stop is mounted on the panel, above and to the left of the Q dial, against which the movable pointer is normally placed, except during a measurement of Q.

The Q dial is backed with a piece of white vinylite (heavy cardboard would do) on which is drawn the calibration in India ink, and a protective coating of lacquer added.

A vernier-driven dial is used, and highly recommended, for the main frequency control, since the resonance indications are extremely sharp. A vernier scale would be a further improvement, though not found indispensable.

Method of Operation:

This will be dealt with more fully in Part II of this article, but in brief the method is as follows: To measure the inductance and Q of a coil, the test terminals are shunted by a fixed "standard" capacity which brings the total capacity at the test terminals (including the output capacity of the instrument, which must be pre-determined) to some round figure, such as 500 mmf. The test coil is then inserted and the resonant frequency is sought, starting at the high-frequency end of the highest frequency band and progressing downward. During this procedure the movable Q pointer is pushed against its stop, and the "Q" dial turned to "infinity" (mid-capacity posi-

tion). The output control is turned full on and the slideback voltage reduced to zero or advanced sufficiently so that the eye will begin to close, and as this happens the slideback voltage should be increased bit by bit, until at resonance it is usually possible to set at maximum. The output control is then turned down to the point where the eye is just fully open (just beginning to close) with the Q switch on "HI." The Q switch is then flipped to "LO" and the Q dial rotated clockwise until the eye is again just fully open. The movable pointer is then moved on to the "Infinity" mark, and the Q dial is rotated counterclockwise back past resonance until the eye is again just fully open. The pointer now indicates a Q reading which, when multiplied by a "Q correction factor" for the particular Freq. dial setting, gives the true Q of the test circuit. The method of calibration and obtaining "Q correction factor" will be described in Part II of this article. The resonant frequency is obtained, of course, from a calibration curve for the Freq. dial, and from it the inductance of the test coil is calculated from:

$$L = \frac{25.33 \times 10^9}{f^2 C} \text{ microhenries} \quad (2)$$

where f is in Kc./s
and C is in mmf.

If the Q of the test coil is too high or too low to give a suitable reading on the Q dial, it is merely necessary to tune the frequency dial to one of the sub-harmonics of the resonant frequency and repeat the Q-measuring procedure. The sub-harmonic frequency so chosen should be such as to give a higher or lower Q multiplier as required.

When it is desired to measure capacity with the instrument the same general method is employed, except that a standard coil of known inductance and distributed capacity is required. The value of Cx from the resonant frequency measurement is then:

$$C_x = \frac{25.33 \times 10^9}{f^2 L} - C_d - C_o \quad (3)$$

Where Cd = distributed capacity of coil in mmf.
Where Co = Capacity of output terminals in mmf.
Where L = Inductance of standard in microhenries.
Where f = Frequency in Kc/s.

Part II, "Calibration, Results and Further Uses," will appear in the next issue of XTAL. In it will be described the method of using the instrument to distinguish between the true inductance and the effective inductance of a coil, to measure its distributive capacity and to determine the co-efficient of coupling between coils. A step by step procedure for carrying out calibration of frequency and Q dials will also be described. This will be accompanied by photographs.

. . . . . .

References:
1. "Circuit Constant Checker," G. Zabaris, Electronics, Oct., 1944, p. 118.
2. "A Direct-Reading Q Meter," Rufus P. Turner, Radio News, July 1943, p. 20.
3. "Cathode-Coupled Oscillator Circuit," Electronics, May 1945, p. 234.

WORKED ALL VE

Back in 1939, the VE Operators' Association sponsored "WAVE" certificates. Up to the time war put us off the air no one submitted proof of working all Canadian provinces according to the rules, of working two different stations in each province on different bands. We never did think the certificate was easy to obtain. Perhaps it will prove more difficult than WAC. Who will be the first to turn the trick?

"WAVE" Certificate Rules

1. The applicant shall submit proof of contact with two different stations in each province, contacts being on different bands (total of 18 confirmations). Yukon Territory and North-West Territories shall be considered as part of British Columbia.
2. All contacts for which the award is claimed shall be made on or after January 1st, 1939.
3. Applicants residing in territory designated by the prefix VE or W shall make all contacts from within one province or state.
4. The sum of twenty-five cents shall be forwarded with application to defray costs and return postage on cards. The fee shall be waived if the applicant is a member of the VE Operators' Association.

Many thanks to VE3QK for the cover on our last issue, and to VE2GT for the one on this issue.

How About the Power Supply?

By T. I. MILLEN, VE3AEW

How many of our troubles are caused by a poorly designed D.C. power source. Here are a few:

Motor-boating in audio systems;
Hum in audio and R.F. systems;
Chirpy notes;
Poor stability in oscillators;
Distortion in class "B" amplifiers due to high resistance bias supplies, etc.

In an attempt to eliminate any or a combination of the above troubles, heavy duty, over-designed power units using large and complicated filters have been used. De-coupling on all but power output stages are the rule, and in some cases separate power supplies must be used. All of these expedients result in a bulky and costly 'rig.'

There is another way to tackle the problem which, in some cases, reduces the size and cost of the overall rig; can always be designed in such as way as to eliminate the above troubles and at the same time remove nearly all the de-coupling circuits. This is to use an electronic voltage regulator to feed all the critical circuits. Typical regulators as illustrated maintain the power supply output voltage constant to a greater or lesser degree, depending on the design, while the load current or input voltage changes within fairly wide limits. Simultaneously this action reduces the hum output considerably, since output hum from the filters is actually just a varying input voltage to the electronic regulator. For this reason much smaller and consequently less costly filters can be used.

GAS REGULATORS

This type of regulator makes use of the fact that the voltage drop across the glow discharge of some gasses is very constant for large changes in operating current.

An example of this type of regulator tube is the VR105 or VR150. The characteristic curves of these tubes are shown in Fig. 1, and the typical circuit is shown in Fig. 2.

As the operating range of these tubes is 5 to 30 ma. (from the graph), the centre of the operating characteristic is therefore 17.5 ma. For maximum regulation and output current, this is the best operating point.

Somewhat higher load currents can be

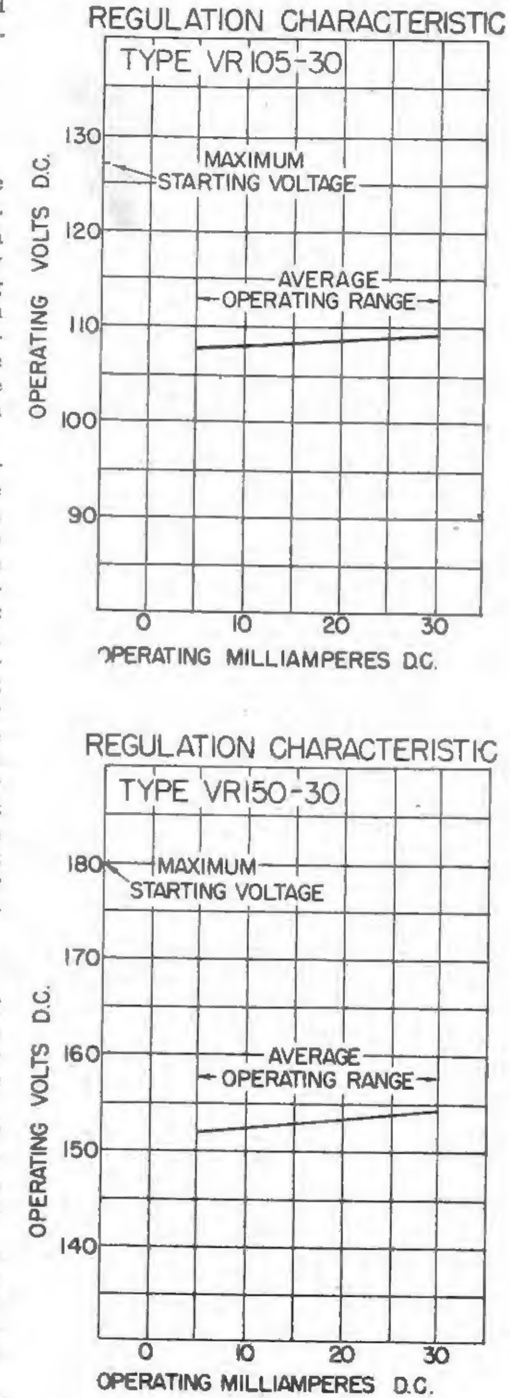


FIG.1

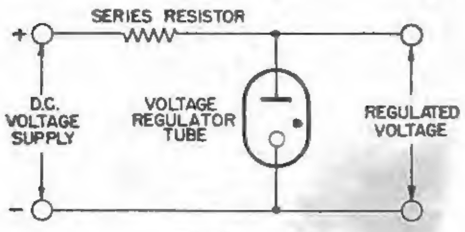


FIG 2

drawn if the load is relatively constant, or if poorer regulation is acceptable.

The D.C. source voltage must be greater than the striking voltage of the gas tube, which is 127 volts in the case of the VR105; however, a value about twice the output voltage is desirable.

Under these conditions the equivalent resistance of the regulator as a source of power is about 40 ohms for a single tube, and twice this value for two in series.

The size of the resistor in series with the gas tube or tubes is such as to give the required voltage drop between the supply voltage and the output voltage at the tube operating current plus the load current.

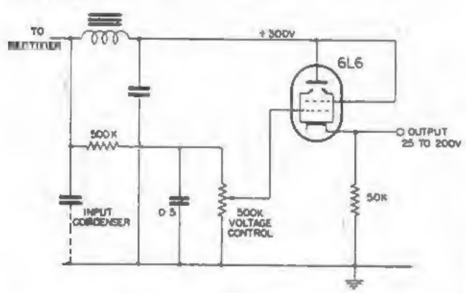


FIG 3

CATHODE FOLLOWER REGULATORS

Figs. 3 and 4 show two types of regulators making use of the low output impedance of a cathode follower. The circuit of Fig. 3 is one which maintains the output voltage constant with changes in output current only, while the circuit of Fig. 4 maintains the output voltage constant for both input voltage and output current changes. The disadvantage of this type of regulator is that it requires a constant source of potential such as a battery or other constant voltage. However, it should be noted that the battery need not supply appreciable current, and its life should be equivalent to shelf life.

Fig. 5 is the above circuit with the battery replaced by a gas tube regulator. This eliminates some of the undesirable features of circuit 4.

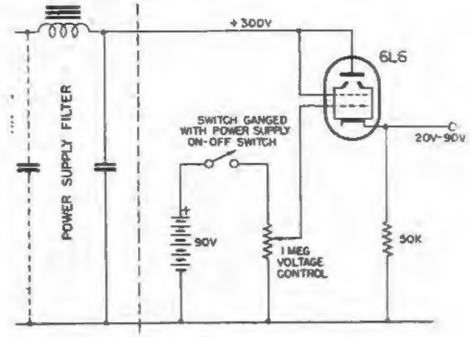


FIG 4

It can be proved that the output impedance of this type of regulator is very closely equal to $\frac{1}{Gm}$

where Gm is the transconductance of the tube used. A simple explanation of this statement is noted here. In Fig. 3, let us by some outside means move the cathode one volt positive. This changes the voltage between grid and cathode by one volt. The tube current will now change an amount =1 x Gm. The equivalent impedance of this circuit is equal to

$$\frac{I}{E} = \frac{1}{1 \times Gm} = \frac{1}{Gm}$$

By using a high Gm tube such as a 6AC7 or for higher current a 6AG7 the output impedance can be made as low as 100 or 200 ohms. While this impedance is fairly high compared with other regulators, the hum output is practically zero with as much as 50 volts hum on the input. In the case of Fig. 4 or 5, changes in line voltage produce a negligible change in output voltage.

The maximum output current limitation on this type of regulator is the maximum safe current and plate dissipation of the vacuum tube.

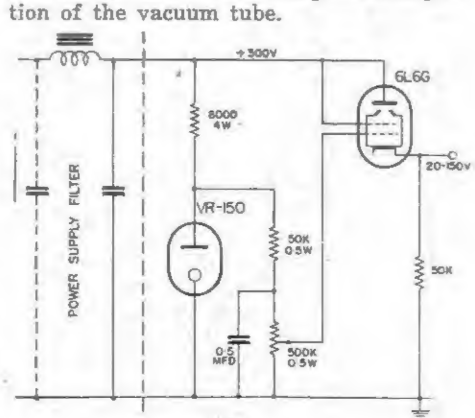


FIG 5

(Cont'd on page 28)

Some Visible Definitions

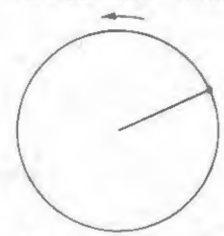
Re-making Acquaintance With a Few Basic Radio Terms

By W. H. ANDERSON, VE3AAZ

No doubt you recall those high school math. assignments about the ladder leaning against the wall—how much tension is on the rope that keeps it from slipping out at the bottom, etc.? Those problems were set on the triangle or parallelogram of forces, and while solution could have been made by purely mathematical means, they became much clearer to the eye by construction of a figure with the various forces represented by lines (to scale if desired).

These lines are termed vectors, and the vector method of approach is particularly useful in radio matters, due to the difficulty in visualizing the various component forces at work. The ham, with his fundamental distrust of mathematical solutions and expositions, will find it an especially useful tool.

SINE WAVES AND VECTORS

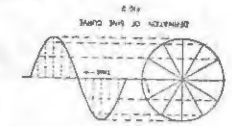


BASIC FOR ALTERNATING CURRENT OR VOLTAGE

FIG 1

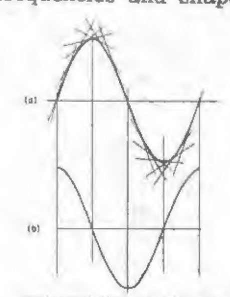
Just as all mechanical processes can be traced back to the wheel, similarly the circle is the basis of vector relations. Any alternating voltage or current can therefore be represented as a tiny pellet on a string whirling counterclockwise around a point with a speed equal to one revolution per cycle—e.g., 7 megacycles represents 7,000,000 revolutions per second (see Fig. 1). Now, if one plots the position of the pellet on the circumference of the circle against time, the result will be the familiar sine curve (Fig. 2).

The sine curve is significant for more reasons than this, however. A theoretically perfect condenser has infinite resistance to direct voltage (the author would like at this point to start a one-ham crusade against such terms as "alternating-current voltage" and "D.C. current"—surely AV, AC, DV and DC



cover the situation with no ambiguity and no double-talk); in other words, the free plate is not influenced by the other plate, because the potential on the energized plate is not changing. Similarly, a coil of wire has only its ohmic resistance to DC; it only begins to exhibit inductive properties when the current through it is changing. Since we may say that DV is a voltage of zero frequency, an examination of the "rate of change" of an alternating voltage should be revealing.

If we were to take the sine curve, and examine it for its rate of change during the cycle, by means of tangents along the curve (Fig. 3), we note that the tangents rotate at varying speeds in a clockwise direction for the first half cycle, then reverse and rotate at varying speeds in a counterclockwise direction. If we made a curve of these findings, it would be as in Fig. 3B. This curve can readily be seen to be of the same form and frequency as the original sine curve—only moved over a quarter-cycle. This relatively simple fact accounts for the universal usage of sine waves as a standard waveform for AV and AC. When a sine wave AV encounters a condenser or inductance, the current is therefore of the same frequency and "shape" as the voltage, with only a time element introduced. In the case of voltages of other wave-forms, the resulting current is a complex combination of several frequencies and shapes.



RATE OF CHANGE OF SINE CURVE

FIG 3

LAG AND LEAD

If we reflect for a moment on the characteristics of condensers and inductances, further conclusions as to the aforementioned time element may be made. When AV is applied to a condenser, there is a rush of current to charge it, in time the voltage across the condenser builds up—so it is said that in a condenser the voltage lags behind the current 90°. On the other hand, an inductance always tries to maintain its current at an even value, so when the voltage is reduced the current hangs on at its former value for an instant before decreasing—so it is said that in an inductance the current lags the voltage 90°.

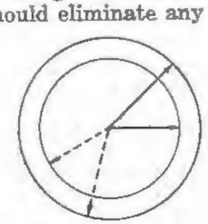
These relationships are the very basis of alternating current phenomena. Similarly basic are the equations for the reactance offered to an alternating current—namely, for inductances: XL (inductive reactance in ohms) $= 2\pi FL$ where $\pi = 3.14$, F is frequency in cycles per second and L is inductance in Henries. For condensers: XC (capacitive reactance in ohms) $=$

$$\frac{1}{2\pi FC}$$

where π and F are as before and C is capacity in farads.

PHASE

In a circuit that contains inductance and reactance (and consequently cannot be solved by direct application of Ohm's Law) we must add another rotating element to our basic relationship of Fig. 1, since both voltage and current are changing with respect to time. The term "phase" refers to the angle, if any, between two vectors, while "in phase" indicates that there is no angle; in other words, they coincide. In Fig. 4 the voltage and current are 45° out of phase—the same would have been said had the vectors been in the dotted positions. The situation of having one line contain one or more vectors makes radio vector diagrams somewhat more complicated than the simple triangle of forces, but correct labelling should eliminate any ambiguity.



CURRENT AND VOLTAGE VECTORS---PHASE
FIG.4

INDUCTANCE AND RESISTANCE IN SERIES
FIG 5

VECTOR SOLUTIONS

It is quite easy to solve for the impedance of a circuit such as Fig. 5A by the familiar formula

$$Z = \sqrt{R^2 - XL^2}$$

however, this leaves the impression that the circuit could be replaced by a resistor of that resistance, with exact equivalence. Construction of the vector diagram demonstrates the inaccuracy of this assumption. Since the current is common to both members of this circuit, its vector is laid out along the horizontal axis (see Fig. 5B). Vectors representing the voltage drops across the elements are now constructed — IR will be in phase with the common current, so will also be laid out along the horizontal axis, but since the voltage in an inductance leads by 90°, the IXL vector will extend up from the origin. The lengths of these vectors will be proportional to their individual impedances since

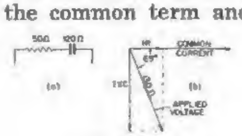
$$\frac{IXL}{IR} = \frac{XL}{R}$$

—the common current term cancelling out. A rectangle can now be completed, and a diagonal passing through the origin drawn. This diagonal will represent the impressed voltage, also the circuit impedance. If the impressed voltage is known, the scale will be determined and the voltage across the resistor and condenser individually can be found. Since the scale for impedances has already been set, the total impedance may be determined. It may seem odd to construct a diagram and solve for the scale, but that is the actual process as regards voltages.

In a similar manner, as depicted in Fig. 6, the solution of a condenser and resistor in series may be found.

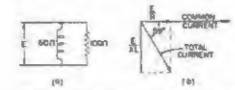
PARALLEL CIRCUITS

Parallel circuits such as Fig. 7A represent a different problem, as here the voltage is the common term and is laid



CONDENSER AND RESISTOR IN SERIES
FIG 6

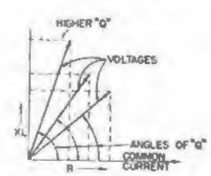
off along the horizontal axis. You will note that this situation brings the vector relating to the inductance below the line, due to the current lagging the voltage as explained above, and a counterclockwise rotation of the vectors being assumed. In the parallel case, the currents taken by the elements (voltage divided by individual impedances) are represented by vectors, and the vector representing their sum will also be a current vector.



INDUCTANCE AND RESISTANCE IN PARALLEL --- NOTE THAT LENGTH OF CURRENT VECTORS ARE INVERSELY PROPORTIONAL TO IMPEDANCES THEY REPRESENT
FIG 7

SIGNIFICANCE OF RESULTS

The position of the resulting vector provides an indication as to the nature of the load the power source is encountering, or in other words, the phase relationships between the applied voltage and the resultant current. You will also note that these solutions all stem from the old familiar Pythagorean theorem that the square on the hypotenuse equals the sum of the squares on the other two sides. This fact facilitates solution after the circuit conditions are visualized by the vector diagram, as scaling a diagram is a rather awkward method of obtaining a reasonably accurate solution. These examples involve only two elements. However, the method can be extended to cover any number or combination of elements by combining vectors two at a time, until a single resultant is obtained.



VECTOR REPRESENTATION OF "Q"
FIG 8

"Q"

You will no doubt recall the definition of Q as the measure of merit of an inductance — being numerically equal to

$$\frac{XL}{R}$$

If we represent this definition as in Fig. 8, we can deduce a few points. First of all, that increasing the Q is equivalent to rotating the "impressed voltage vector" into a position that is nearer 90° ahead of the current. Secondly, that the value Q equals the tangent (opposite side over the adjacent—remember those old trig. variables?) of the phase angle by which the current lags the voltage.

POWER FACTOR

In many discussions of resonant circuits, alternating current power and so forth, the term "power factor" is introduced. In Fig. 5A if one were to place an ammeter in the circuit, it would read the value

$$\frac{\text{impressed voltage}}{\sqrt{R^2 + XL^2}}$$

amperes. However, since the inductance is presumed perfect, it is not actually consuming any power—it is merely absorbing energy one instant and returning it to the circuit the next; all the power is being consumed in heating the resistor. Therefore from the ammeter reading one would gather that the power in the circuit equals

$$\frac{\text{voltage}^2\sqrt{R^2 + XL^2}}{R^2 + XL^2}$$

whereas the actual power consumption is

$$\frac{\text{voltage}^2 R}{R^2 + XL^2}$$

Accordingly the ratio of actual power to "apparent power" is

$$\frac{R}{\sqrt{R^2 + XL^2}}$$

From Fig. 8, this value is seen to equal the cosine (adjacent side over the hypotenuse) of the angle by which the voltage lags (or leads) the current. The produce to AV times AC must be multiplied by the power factor in order to get true power. Unity power factor (power factor $= 1 = $ Cosine 0°) therefore means that the current and voltage are in phase.

This difference between actual and apparent power is of much more than theoretical interest. You no doubt have noticed that large transformers and generators are rated in KVA (thousands of volt-amperes), rather than in kilowatts. The absolute magnitude of the current determines the wire size, heat dissipation, etc., even though this current may not represent much power. Transformers with open secondaries, for instance, present a very inductive load (current lagging) to the line.

Looking in Through the Open Door

By F/S H. S. O'BRIEN, R.C.A.F.

The doors of the Canadian Amateur Radio Operators' Association are wide open to non-licensed amateurs for Associate Membership. We realize that many hundreds of amateurs have no license through no fault of their own, but that they simply were just getting nicely started when the war forced the lid on. Associate membership in the VEOPS is just a stepping stone, a means to an end. The code and theory classes that are now in operation across Canada are fully preparing amateurs to take their exam. as soon as the station license restrictions are lifted, thus becoming fully qualified members. Of course, exams. for "Proficiency Certificates" can be held at any time at your local radio inspector's office.

The increase in the number of licensed hams in the first few post-war years has every indication of being enormous. Operators trained in the services will desire to further their training. Many who felt they could not afford equipment may now be in a position to realize their ambitions. Hams who, for reasons of their own, had dropped their hobby to chase the elusive dollar, have been back at the old trade in war plants with interest kindled anew, and are itching to get on the air again.

XTAL is the official organ of the Association, and by means of this publication the hams of Canada will be kept up to date on the happenings across the entire Dominion. We believe that now is the proper time to make every ham realize the need for "Continent-wide" organization. Since all districts are represented, the nucleus of the VEOPS is truly national, and will give the old and new ham alike the best administration possible. The size of XTAL is slowly increasing, and more and more technical articles will appear as time goes on. Material for publication is most welcome from everyone. Articles should be legibly written. Don't worry about your English — just make sure that your diagrams are correct, and that your parts list is complete, showing parts with their electrical characteristics. If the articles are too lengthy, we will edit them, and if they are complete they can't be too short.

We list below the new Associate Members up to August 30th, 1945:

F/S H. C. O'Brien
Hugh Bennett
Alex. Demeter
R. Cartmill
Reg. Argyle
M. E. Venn
O. R. Taylor
E. W. Leaver
H. Douglas
Jas. Sheppard
H. McInerny
W. J. King
Geo. Hargraft
Leo Jarvis
Jack Ward
S. V. Soanes
F. L. Attwood
J. S. Adams
L. C. Smith
F. W. Toy
R. Mayhue
H. D. Iler
G. A. Richards
C. B. Mackay
H. W. Arnold
G. Reesor
J. R. Thomson
W. W. Wynn
C. L. Turton
WO2 N. Farr
E. D. Smith
Keith Cain
Alex. Andrews
Geo. Dellinger
B. D. Hunt
H. Yerex
E. Collins
K. E. Coates
R. G. Andoff
H. Cottington
R. S. Delaney
C. D. Groom
G. E. McCullum
W. B. Lunn
Harry Brown
Harry Morse
R. Allison
Frank Morton
George Pope
Frank Strang
W. B. Reilly
H. O. Tovell
K. L. Wardle
G. E. Smith
Miss W. Seymour
J. Posnikoff
H. R. Lepard
J. M. Parker
W. E. J. White
M. R. Pyatt
A. O. Leach
M. G. Lovell
D. W. Frick
B. J. Wickett
C. H. Drew
O. E. Smith
Clare Hughes
R. J. Mitchell
Stan. Tipping
W. T. J. Wiltshire
J. E. Dale
H. C. Gillmore
Oliver Lovell
Len Wilson
Jack Harris
G. L. Graham
C. J. Purdy
Jay LaHay
Robt. Hewett
D. A. Henry
M. Coyle
C. Bradstreet
Lance Holden
B. Powell
N. Sutherland
J. Duncan
J. A. Winter
K. L. Bryant
J. W. Flintoff
D. B. Black
Lou Gold
D. Beattie
Ray Frey
T. Parnell
Sgt. J. Pousetti
G. S. Boyd
Stk. 1/c T. Johnson
J. P. Tangen
R. H. Loree
A. J. Dinnin
Paddy Kidd
Bill Turner

(Continued on page 30)

MANAGES TELECOMMUNICATIONS DIVISION OF ROGERS MAJESTIC

R. M. Brophy, president of Rogers Majestic Limited, Toronto, announces the appointment of S. G. Paterson as manager of the Telecommunications Division of the company.

The Telecommunications Division has been established for the purpose of developing the company's activities in commercial electronics, i.e., police, fire, forestry, public utility, urban transit, railroad, as well as the general point-to-point communications field.

Mr. Paterson has an extensive knowledge of all phases of radio, gained during the past eighteen years. He is particularly well informed in the field of transmitters for radio broadcasting and in specialized radio communication applications. He recently completed arrangements for the installation of two-way radio equipment on Canadian National locomotives — the first installations of their kind in Canada.

His previous connections with the radio industry have been with Electrical Supplies Limited of Winnipeg; and with Canadian Marconi Company, first in a sales capacity in Western Canada, and more recently as manager of the Commercial Sales Department of that company in Montreal.

The amateur fraternity will remember him as VE4DY, Winnipeg, Manitoba, which call he held from December 1920 until the war.

POWER, DOLLARS and SENSE

(Cont'd from page 16)

hundreds of Ve's and W's from England. A careful log was kept of the stated power at the transmitter and the type of aerial used. By an overwhelming percentage the loudest and most consistent signals arrived from stations having really good aerials—power was a secondary consideration.

You will remember that the average G was licensed for ten watts input (250 volts at 40 ma. for instance) INPUT INTO THE FINAL—yet you heard them over here quite often. The reason was the extreme pains taken in the care of X and feeding of the antenna system.

Have you sent your letter in?

Gleanings from the Mail Bag

VE1OD has been doing construction work for the Armed Forces down on the East Coast all through the war. Carl Robinson, 3AE, is at present occupied in the Radar Workshop, R.C.E.M.E., at Kingston, Ontario. 4CI and 4APS await the "go" signal at Spy Hill, Sask. 3DM, Mord. Millard, is worrying about a new speech amplifier, and still reports from Coldwater, Ont. 3APF has moved to 86 Indian Grove, Toronto. 3AJS reports on the old Belleville gang that 3XQ has located two 75 ft. trees, has persuaded a farmer to part with them, and now worries about transportation. 3AAR is in U.K., a F/L in the R.C.A.F., has met a new YL over there and plans matrimony before the year's end. 3RW has spent the years installing electrical equipment in tugs for overseas service. 3AOP manages a shoe store now. 3EG is at Debert, N.S., and plans 813s for his rig, while 3AJS labours over the woodwork for a 14 mc. rotary. F/O Lloyd Jones, 3SN, is back in Galt, after being away for four years. IEL, of Moncton, thinks some of the VE1s would travel to VE3 for a real Hamfest later on. 3AAZ is with T.C.A. at Moncton Airport, and reports some interesting studies with regard to weather and high frequency propogation. 3APS contemplates the addition of a bug to the junk. 5BM is now living in Victoria, B.C. 3AQJ has been in the R.C.C.S. since early 1941, and expects to be for some time yet. 3HP, ex-SCM, plans H.P. 1GG, Mr. and Mrs. Bill Snell await the signal at Sydney Mines, C.B. 3AJQ wonders if we'll get our old tickets back, and if a new exam will be necessary. He is still at R.R.4, London. 5CV is now at St. James, Man. Before he moved to "The Territories" he was 3ADU. 3ANU, Toronto, pines for ham nights again. 3FB is with R.C.A.F. at Debert. 3ER reports that he, 3AGB, and 5ABO are all at Whitehorse, Y.T. At the other end of Canada 3AMP, with R.C.A.F., reports from Torbay, VO-land that 3KW is back from overseas and now with R.C.A.F. at Clinton, and 3AXO also back and now at Dryden. 3AUC still worries about the birds and bees at Niagara-on-the-Lake. 1CK, Bill Gammon, gave up potatoes for the R.C.A.F. in October, 1940, and is a Signals Officer at Cape Bauld, Nfld.

3ALT writes from Kirkland Lake that he has been doing rockburst research at Lakeshore Gold Mines. 3AFR is back from three years' service with the R.C.A.F. and is servicing sets at Kirkland Lake. 3ABW is at Gaspe, Que., with R.C.A.F., and reports 3AFW and 3AZX are still overseas, 2KM at Halifax, and 4OQ in Landis, Sask., all being in R.C.A.F. also. 5AAJ is also another R.C.A.F. ham, and now at Prince George, B.C. 3AMS is reported overseas with R.C.A.F. 3BC's XYL is in Canada awaiting. 3ACB is still working on Lankies and Lincolns at Fleet Aircraft in Fort Erie, and pines to light up the "old," or rather the "new" rig. Manly Haines, 5MQ, and F/S H. C. O'Brien visited No. 5 Radio School, R.C.A.F., Clinton, Ontario, recently, where they ran into F/L "Red" Herring, 3MS, and F/L Ralph Reid, of Watrous, Sask., a VE4. The trials and tribulations of radio men in India were pointed out by Ralph and Red, both recently returned from an extensive sojourn in all parts of India. The efforts of the Royal Indian Air Force girls in re-winding transformers were highly praised. "Red" tells of boiling condensers in order to prevent extensive breakdowns. The QRM increased in India's bigger cities when "Red" and S/L Tommy Carpenter, 3BD, ran into each other and decided to investigate all of Mother India's nooks and crannies (dives?). S/L Roberts, 4GM, officers' instructor at Clinton, reports considerable activity in the forming of a radio club at the school. 3PX, W/O Bill Yeo, passed through Toronto recently on the way to the Pacific. 3MS has gone in the opposite direction. 3SG has a farm at R.R.1, Cooksville, Ont., now, and reports his 400 chickens FB. He would like to see any of the gang as they go along the Dundas Highway. It is on the south side, 2 miles west of Cooksville behind a red brick wall. Word from 2BM, 3JI, 3ALC, 3PJ and 3QE is acknowledged. 3AAO and 3YK are both P/O's stationed with R.C.A.F. at Mountainview, Ont. George Wells, formerly of St. John, is now residing at 146 Hillcrest Ave., Montreal W., P.Q. 4AEO, Bob Pollock, is still with the Navy on the East Coast the last we heard. 4WU, Oakley

(Continued on page 32)

Letters to the Editor

Whitehorse, Y.T.,
July 13th, 1945.

The Editor—XTAL,
Leaside P.O., Ont.

Just happened to catch a glimpse of a copy of QST, July issue, and, being one of the old gang of hams who used to be quite active up until the war started, it was a pleasant treat, as I haven't seen or heard any news about the old gang for some time.

I guess before I go any further I should introduce myself. I am Tommy Bilesko, VE3AGB, better known as "Another Gas Bag." I have been in the R.C.A.F. for about two years now. I started out in the Service as a Wireless Mechanic, but due to sickness and landing in the hospital while on courses at Winnipeg, I was washed out of the course and could not go back on class as it was the last class of W.E.M.'s going through. I remustered to the Motor Transport, as I like driving, and after spending about ten months stationed near Dauphin, I was finally posted up the "Route." I spent five quite interesting months at different stations before being sent up here to Whitehorse, or the Land of the Midnight Sun.

I have gotten to know several of the radio boys up here. I drive them out to the Xmitting site every day, so have had a chance to see some of the junk here.

I would be tickled to hear from any of the old gang if you would tell them. I was home on leave last month, but the only ham I ran into was 3AHX, and I happened to see him downtown in a radio supply store. I ran into a VE5 ham out at the R.C.C.S. shack the other day and had quite an interesting chat. He was telling me that we may be getting back on the air soon. I certainly hope so, 'cause it would really be swell if we could set up a little rig here and maybe contact some of the gang from this neck of the woods.

This Yukon country surely is lovely, but I would still rather be back in the land of the VE3's.

I still get mail quite regularly from Floyd Gibbon, 3LR, down in Montreal, but he is the only one of the old gang who still answers my letters. I surely could use some news from anyone who cares to write to me, 'cause I am awfully homesick for ham news, ham talk, or anything to do with those good old days. I will answer letters from everyone, as mail is greatly appreciated. About the only faithful person I can depend on is the XYL.

I guess that just about covers all the dope on myself and what I have been doing. If you should happen to have any extra copies of XTAL I would be happy to get them to pass on. Airmail is about the best way to send letters here, as the roadmail is quite slow, but if letters are addressed to our station in Edmonton, then they come up on the daily R.C.A.F. "Sked."

For airmail my address is:

LAC T. Bilesko, R282861,
R.C.A.F. Station, Whitehorse, Y.T.

For roadmail my address is:

R.C.A.F. Station, Whitehorse, Y.T.
c/o M.P.O. 1315, Edmonton, Alta.

Yours sincerely,
TOMMY BILESKO,
VE3AGB.

Muskoka Hospital,
Gravenhurst, Ont.

The Editor—XTAL,
Leaside P.O., Ont.

It was with considerable delight that I picked up my first copy of the new series of XTAL. Having heard so much about the activities of the regenerated VE-Operators' Ass'n I was greatly interested to see for myself what steps had already been taken to put this association on the map, as it were. It would seem that the necessary steps have already been taken and that now it's only a matter of time and co-operation from the hams themselves. My contact has been Ivor Nixon, 3ACL, who has been keeping me very well posted on the ham doings in the Queen City.

May I offer a suggestion? Although this first issue is sketchy in regards to technical articles, and I can understand how it likely has been difficult to find material, I would suggest that such articles as that of the 12,500-mile "Two Tube Receiver" be left out in future issues. It is suitable material for such publications as "Short-Wave Craft" and the like, but I feel that hams have passed

(Continued on page 32)

WARREN NEW CHIEF ENGINEER FOR ROGERS MAJESTIC

Appointment of James R. Warren as Chief Engineer for Rogers Majestic Limited, Rogers Electronic Tubes Limited and other subsidiary companies, is announced by W. G. Robertson, Vice-President in charge of manufacturing and engineering.

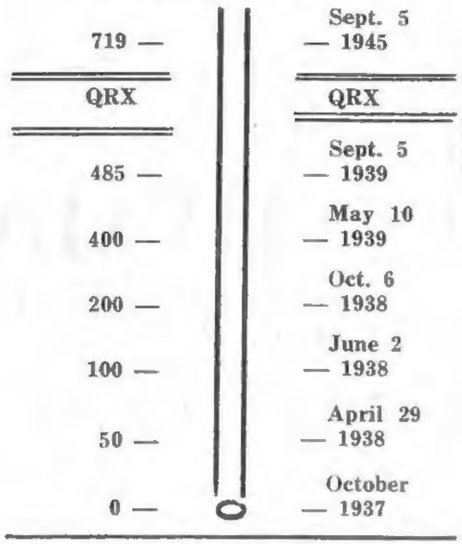
A member of I.R.E. and the Association of Professional Engineers of Ontario, Mr. Warren has extensive experience in all phases of electronic production. For several years he has been with Research Enterprises Limited, in charge of engineering development of radar equipment, and of tube development and production. His work for R.E.L. took him on a number of trips to Britain in connection with the technical development of radar and other electronic equipment for marine and aerial navigation and operation. For some years previously he was connected with Canadian Westinghouse. He is a graduate of the School of Practical Science of the University of Toronto.

Although Mr. Warren never became a licensed amateur, many of the fraternity benefitted from his counsel regarding technical kinks.

ARE YOU A VE OPERATOR?

HAVE YOU JOINED YOUR ASSOCIATION?

MEMBERSHIP GRAPH



SHORTS

VE5ADN, Sgt. Peter Wekel, R.C.A.F., who was an instructor at No. 1 Wireless School, Montreal, when the school was moved in the fall of 1944 to Mount Hope, Ontario, went along with the school. With the training of wireless operators ground and wireless electrical mechanics completed in March, he was posted overseas.

VE5IO, M. Reade, and XYL, another VE5, returned to Cranbrook, B.C., after two years with Inspectorate Radar, Inspection Board of U.K. and C., at Research Enterprises Limited, Leaside, Ontario.

3AMO wants to know if the Potentiometer, P1, in the schematic in the June issue re "Introduction to Cathode Ray Oscilloscope Design" is for the use of hams who aren't particularly interesting in adjusting anything. (Our schematic helper apologizes. Ed.)

Please advise promptly any change in address

ABOUT POWER SUPPLY

(Cont'd from page 11)

A 6L6, for instance, will pass about 75 ma. safely, and two in parallel twice this value ,or 150 ma., with a voltage drop of 150 to 200 volts.

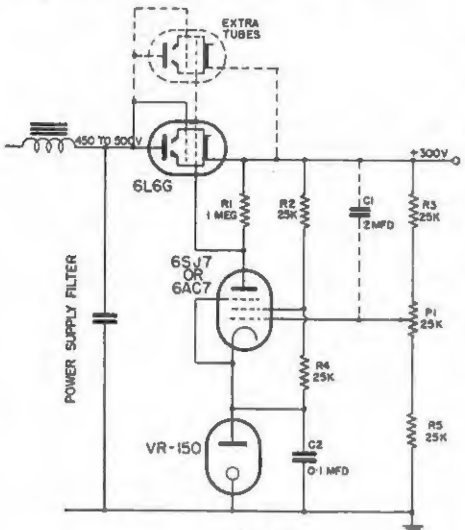


FIG. 6

PRECISE REGULATORS

Fig. 6 illustrates the most popular regulator circuit of a more complicated design. Here the output voltage is maintained very constant for both input voltage and output current variations over wide limits.

The internal resistance is in the order of 1 to 5 ohms and the hum output is negligible.

The action of this regulator is as follows:

If for any reason the output voltage tends to rise, the voltage change is passed on to the grid of V2 through R3 to the arm of P1. This reduces the bias on V2, causing its plate voltage to drop. The drop in plate voltage on V2 increases the bias on V1, tending to cut off.

This action, therefore, counteracts the original change in output voltage, bringing the voltage back very close to the original value. A decrease in output voltage is compensated for in an equivalent manner.

The maximum current available from this regulator is limited by the maximum rated current and dissipation of the tube V1; however, several tubes may be connected in parallel to give the required current rating.

Any of the above regulators may find use in the amateur station, depending upon the particular job to be done, especially in cases where the troubles mentioned in paragraph one are hard to lick.

ATTENTION

A list of all VEs who served in His Majesty's Services and in 100% War Industries is being compiled. Please let us have your status, and also that of any of the VEs you know.

Have we heard from YOU?

APPLICATION FORM

THE VE OPERATORS' ASSOCIATION

LEASIDE P.O., ONTARIO

I hereby make application for (renewal) (new) membership in the VE Operators' Association. One dollar is enclosed, which entitles me to membership and subscription to XTAL for one year from the date of this application.

NAME .... CALL ....

ADDRESS ....

Proficiency Certificate No. .... Date ....

Cpl. R. C. Bennett
Ed. LaBlonc
V. Huckle
J. Hudyma
J. R. Watson
J. G. Gauthier
Fred Sutton
A. Windle
Capt. D. A. Lea
Capt. A. H. Tuxworth
V. A. Rafuse

E. A. Smith
C. H. Fraser
Herb. Barker
R. B. Dierlam
WO2 S. E. Barnett
J. A. Coons
R. M. Sundt
A. C. Hudson
A. G. Campbell
Cpl. C. A. Fudge
A. E. Groom

Below are some of the new licensed Members since the last list:

M. C. McDonald, 3ALS
Howard Medd, 4ZA
R. F. Ward, 3AJD
G. C. Perrin, 3AJT
E. A. Ainsworth, 3ZL
J. E. Wetherill, G5UB
G. F. Kelk, ex-3AWK
E. L. R. Webb, 2IW
G. G. Pipe, 3XJ
G. A. Milmine, 3AND
G. C. MacAuley, 3JO
Monty Johnson, 3ZF
Wm. Wiggelsworth, 3JF
R. M. Bishop, VO2F
R. A. Hackbusch, 9AW
Mel Burgess, 3ATS
Harley Henry, 3QE
W. H. Anderson, 3AAZ
Bob Humphries, 3ALC
E. Newnlam, 5ABO
D. W. Paterson, 4UP
Alf. Miller, 4UK
G. R. Finley, 5TB
T. Bilesko, 3AGB
E. B. Griffin, 3XV
S. Burnett, 3GK
C. L. Skelding, 5CV
J. H. MacKay, 1GO
Gene Hitchon, 3AJS
W. B. Blackhall, 3APF
Robert Piper, 4APS
C. S. T. Walker, 4CI
S. J. Craig, 5FY
C. Littlewood Jr., 5ABQ
E. Neilson, 5AJ

(To be continued in next issue)

HAMFEST!!!

The Entertainment Committee is planning another big night some time in October. The week of the 15th is the date planned now.

One of the big features of the evening will be an auction sale. If you have any gear stowed away, now is the time to get it out, look it over, and if it serves no further purpose, drop it in to any one of the four larger Toronto radio stores, tagged with specifications, your name and address, call, if any, and your reserve bid. These parts will be picked up, catalogued, and put on display at the Hamfest.

It is expected to have the Alka-Seltzer quizz program again, as well as speakers, prizes, etc.

For further information on exact date, time and place, keep your eye on the local radio stores, as well as in the next issue of XTAL.

Gleanings From the Mail Bag

(Cont'd from page 22)

Qwillam, has been building planes in the U.S.A. 4AMI, Hugh Reid, is with R.C.N. in Pacific. 4AEQ and 4OB are busy making copper and zinc at Flin Flon, and await airwaves again. 4AQH left Flin Flon for greener pastures. 5DV is with CFAR at Flin Flon. 4AHE is still in Miami, Man., and 3AXQ in Peterboro, Ont.

LETTERS TO THE EDITOR

(Cont'd from page 24)

the diaper stage and can well afford to leave such elementary stuff to the magazines that cater to beginners and SWL's. After all, don't we prefer to read something about which we have little or no knowledge or rather a new way of doing something which has merits that indicate it's inclusion in our ham magazine. That has been my impression from the first glance and I pass it on for what it's worth.

As far as I know I am the only licensed ham up here, but there are one or two chaps who service radios and keep the listeners happy. Naturally our activities are somewhat limited, but the spirit is strong although the flesh may be weak. Good luck to you all.

Sincerely yours,
HARVEY REID, VE3ADR